Patent claims:

1. A process for producing moldings, workpieces or structural elements from or with foamed metal on the basis of aluminum or aluminum alloys or other metals or alloys, in which process semifinished bodies, bars, profiles, plates or the like of foamable semifinished material, obtained by powder-metallurgical means by compacting a mixture of at least one powder of the matrix metal with at least one foaming agent which releases a foaming gas at elevated temperature and is based on at least one metal hydride or some other foaming agent, are introduced into a foaming and shaping mold or the like, are arranged there in the respectively desired geometrical arrangement and two-dimensional and/or three-dimensional distribution, and are brought to a temperature in the range of the melting temperature of the matrix metal in the said mold by heating, the foaming operation is ended after filling of the cavity of said mold to a desired degree with the foamed metal formed and, finally, the foamed metal moldings, workpieces or structural elements obtained in this way are demolded or removed, characterized therein, that

- at least one foamable, compacted semifinished body or a plurality of semifinished bodies of this type is/are introduced into the foaming and shaping mold, together with at least one structure or body formed from a material or solid material or metal, the aforesaid not being foamable at the melting temperature of the matrix metal or foaming temperature and/or a (technical) functional structural element from the group comprising wires, cables, bars, networks, gratings, foils, plates, sheets, honeycomb bodies, profiles, tubes, bushes, anchoring elements, screw shanks or the like, and is/are held in the desired position, after which the heating is performed with formation of the foamed metal, enclosing or contactbonding the structure or the (solid) body and/or functional structural element integrally and snugly in the form or shape corresponding to the mold cavity,

- the material or matrix metal of the foamed metal formed at the respective foaming temperature being brought into contact with the entire structure or (solid) body and/or functional structural element or with a part of the same, and

- after appropriate cooling, the composite molding or structural element obtained, with a structure firmly bonded in the foamed metal, or firmly bonded (solid) body and/or functional structural element, is demolded.

2. The process as claimed in claim 1, characterized therein, that
- during foaming, a metal matrix is formed, which on contact with the structure or structures or with the (solid) body or bodies and/or functional structural element or structural elements

bonds at least essentially material integrally with the same or with the material from which it or they is or are produced, and/or

- structures or (solid) bodies or functional structural elements which, or the surfaces of which, are provided with a coating, adhesive layer, diffusion layer or the like promoting the material bond with the matrix metal of the foam are used, and/or

- structures or (solid) bodies and/or functional structural elements of which the material forming them or their surface-coating material reacts with the metal matrix of the foamed metal at the foaming temperature, forming chemical and/or intermetallic bonds, mixed crystals, solid solutions or the like, are used and/or

- structures or (solid) bodies and/or functional structural elements of which the base material itself, or of which at least one coating, promotes a diffusion between the base material and/or coating material and the foam matrix metal are used, and/or

- the structures or (solid) bodies and/or functional structural elements are produced from a base material of which the surface melts essentially at least in the range of the foaming temperature of the matrix metal of the semifinished bodies, or have a coating with an alloy, phase or the like melting essentially at least in the range of the foaming temperature of the matrix metal of the semifinished bodies,

- for the case where foam matrix metals based on aluminum or Al alloys are used, the structures or (solid) bodies and/or functional structural elements have as a diffusion-promoting coating such a coating with zinc, copper, magnesium and the like or their alloys or intermetal bonds with one another.

3. The process as claimed in claim 1 or 2, characterized by

- for the case in which an only partial or loose material-integral bond or an essentially only mechanical bond, in particular a form-fitting bond, is desired between structures or (solid) bodies and/or functional structural elements and the foam metal matrix - the same are produced with a material which is not very reactive, or not reactive, or does not form alloys with the matrix metal of the foam, with a material which is inert or controls, retards, suppresses or inhibits diffusion or even possibly repels the matrix metal, or else are coated or surface-treated with a material of this type, for example a metallurgical release agent, diffusion inhibitor or the like, such as graphite for example, and/or

- the coating bringing about a material-integral bond between structures or (solid) bodies and/or functional structural elements and the foamed matrix metal, or else retarding or possibly largely preventing this type of bond, is applied to the structure or (solid) bodies and/or functional structural elements by spraying on, immersion, vapor deposition, brushing on, pressing on, rolling on, plating, cementation, electrolysis, chemical reaction in solution or the gas phase or the like, and/or

- to promote the at least mechanical or form-fitting bond between the structures or (solid) bodies and/or functional structural elements and the matrix metal foam their surfaces are provided with foam anchoring elements, such as elevations, studs, claws, barbs or the like or with depressions, scores, threads, goffering or like, or at least have a deliberately produced surface roughness.

4. The process as claimed in one of claims 1 to 3, characterized by
- structures or (solid) bodies and/or functional structural elements of metallic or non-metallic solid material, but possibly also (compact) material obtained by powder-metallurgical, powder-ceramic or powder-technological means, for example sintered material, are used, and/or

- structures or (solid) bodies and/or functional structural elements of which the melting temperature or beginning of melting lies at least K, preferably at least 50 K, above the melting temperature of the matrix metal to be expanded are used.

5. The process as claimed in one of claims 1 to 4, characterized therein, that

- the structures or (solid) bodies and/or functional structural elements which are introduced into the shaping mold together with foamable semifinished bodies essentially have a form or shape which corresponds or is similar to the form, shape and geometry of the shaping mold to be filled or of the final composite body, and/or

- the structures or (solid) bodies and/or functional structural elements are arranged and held in position in union with the semifinished bodies to be expanded in a position or in positions in the foaming or shaping mold, or in its cavity, which corresponds or correspond to their desired ultimate position(s) in the finished integral foam metal body or structural element.

6. The process as claimed in one of claims 1 to 5, characterized therein, that

- the structures or (solid) bodies and/or functional structural elements are held in the cavity of the foaming and shaping mold by means of retaining elements or the like of materials which can be "consumed" by the foaming matrix metal, for example are soluble in the same or at least are compatible with the same in terms of alloy and/or structure, or else evaporate or burn essentially without residue, for example by means of filaments, wires, networks, bars, struts, clamps, claws, or the like, in positions, attitudes or the like corresponding to the ultimate position or positions in the finished foamed metal molding or structural element, and/or

- the foamable semifinished bodies are introduced or placed into the foaming and shaping mold in the form of semifinished bodies bound to one another to form flat formations, in particular to form semifinished mats or the like, by flexible elements, such as in particular metal wires, cables, chains or the like, preferably with a composition corresponding to the matrix metal or compatible with the same, or by heat-unstable wires, filaments, yarns or the like of material which is for example combustible at foaming temperature, and/or

- the retaining elements for holding the (solid) bodies and/or functional structural elements in their ultimate position(s) are produced from a material identical to the structural elements or material of the foamable semifinished bodies or from a compacted material, preferably obtained by powdermetallurgical means, which begins to melt and/or foam only at at least K above the melting temperature of the material of the foamable matrix metal semifinished bodies, is similar to the material of the semifinished bodies or is compatible with the same.

7. The process as claimed in one of claims 1 to 6, characterized therein, that, to obtain a sandwich foamed metal composite molding or structural element, a (form) sheet having a planeflat or desired topography, a plate, a foil or the like, of a metal which has been rendered capable of undergoing a material-integral or at least form-fitting bond with the matrix metal or is at least compatible with the same, in particular in alloying-structural terms, for example based on aluminum, nickel, titanium, steel or the like or their alloys, is arranged at least on the bottom of the cavity of a foaming and shaping mold, that is to say below the compacted foamable semifinished body introduced into the same, and wherein just such a (form) sheet, possibly formed differently, a plate, foil or the like of this type, is preferably arranged essentially in the region of the cover of the mold, in any desired relative position with respect to the first-mentioned (form) sheet or in a parallel position with respect to the same, and is held in a position - corresponding to the desired final position in the finished foamed metal body.

8. The process as claimed in one of claims 1 to 7, characterized by

- the foamable semifinished body introduced into the cavity of the foaming and shaping mold or - in the case of using a plurality of semifinished bodies of smaller dimensions standardized in their form and/or dimensions - a stack or the like formed by said semifinished bodies in the mold cavity is given the a shape, form or the like which is designed to correspond to the shape, topography or geometry of the mold cavity to be filled with expanding foam, possibly essentially geometrically similar to the same, and/or

- the cavity of the foaming and shaping mold is charged, filled or loaded with a higher number of foamable semifinished bodies at those locations where an increased foam density is intended in the foamed metal molding ultimately obtained than at those locations where a lower foam density or even foam-free volume regions is or are desired, and/or

- the total volume of the foamable semifinished body or bodies introduced into the foaming and shaping mold is at most 50% and at least 10% of the volume of the mold (less the volume of a solid body and/or functional structural element possibly made to greater dimensions).

9. The process as claimed in one of claims 1 to 8, characterized by

- introducing (solid) bodies and/or structural elements having a closed cavity or cavities into the foaming and shaping mold or into the cavity of the latter, zones or volume regions that are free from foamed metal are created in the finished foamed metal molding, and/or

- zones or volume regions that are free from foamed metal in the finished foamed metal molding are created by (solid) bodies or functional structural elements with an open cavity, that is to say in the form of a hollow profile or tube, being arranged in the foaming and shaping mold with their openings toward is the foamed metal, bearing right up against the base and top or walls of the mold, and/or

- the bodies of the foamable, compacted semifinished product introduced into the mold are formed with in each case a planar outer surface, at least on one side, with which they bear flat on the base of the mold or on a mesh, grating, sheet, plate, foil or the like introduced into said mold, resting on the bottom of the mold and forming the structure or (solid) body to be bonded with the foamed metal.

10. Moldings, workpieces, structural elements or the like from or with a foamed metal composite material, characterized therein that they are produced by a process as claimed in one of claims 1 to 9.